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Q.50 and Trojan in the Mackay District.

J. T. ELLIOTT.

THE two most recent additions to the approved lists for the Mackay mills, namely Q.50 and Trojan, have to date been grown mainly for propagation and field trials, and the 1948 season will witness the first widespread planting for commercial purposes.

No doubt local growers, particularly those who have not yet had experience with either variety, are endeavoring to assess the relative qualities of both canes in planning their approaching planting programme, and the following article, based on the results of farm trials, maturity samples and general observations, should assist growers to clear up the numerous problems that have to be considered prior to the large-scale planting of any new variety.

Both canes have appeared in several trials, on varying soil types, during the 1946-47 seasons and were compared with Q.28, a cane well known to all Mackay farmers. From the summary of results submitted in the following table, growers are able to compare the productive figures of Q.50 and Trojan with Q.28.

TABLE 1.

SUMMARY OF THREE (3) FARM TRIAL RESULTS—SOIL TYPE: OLD SANDY ALLUVIAL.

Variety.	Average Cane per Acre Tons.	Average C.C.S. in Cane.	Average Sugar per Acre Tons.
Q. 50	**32·6**	17·68	**5·76**
Trojan	28·1	**18·14**	5·11
Q. 28	28·4	16·62	4·74

SUMMARY RESULTS OF TWO (2) FARM TRIALS—GREY SANDY FOREST SOIL.

Q. 50	**30·12**	**15·46**	**4·66**
Trojan	17·3	15·03	2·6
Q. 28	23·37	13·8	3·02

From the above results both Q.50 and Trojan performed better than Q.28 on the more fertile soil types, while on the forest farms Q.50 still

showed to advantage with Trojan failing, not due to sugar content but to its inability to crop well on such soils. The marked advantage of Q.50 over Q.28 on both types must naturally impress all growers.

General notes on both varieties:—

Q.50 is a seedling cane selected on the Mackay Experiment Station in 1939 and having as parents P.O.J.2725 and Co.290, and the better qualities of both canes appear to be inherited by their offspring. Q.50 is a reliable and quick germinator, with the primary shoot coming through strongly and then appearing to lie dormant until the appearance of the secondary shoots when the whole stool produces quick growth, thereby producing an even stool and stand. In its very early growth Q.50 sprawls but quickly grows erect with good cover. The cane is a heavy stooler and produces a stick of medium barrel having a compact eye; it is entirely free of hair growth and produces a soft top. Trash is very free—almost self-stripping. Q.50 is a vigorous and reliable ratooner even under harsh conditions (as observed during the 1946 drought). Mature crops showed a large percentage of red rot during the last two bad seasons but appears to be tolerant to this complaint as it did not materially affect the c.c.s. content or germination of this cane. Q.50 is recognized as a mid-season maturing variety (Aug.-Oct.) but shows reasonable sugar early in this season. The cane is suited to a wide range of soil types, varying from medium alluvial loams to poor forest types, but is not recommended for heavy wet or badly drained soils as it shows a tendency to arrow profusely with resultant sideshooting. Q.28 is better suited to this latter type. Its frost susceptibility is unknown but it is considered that this variety will be affected on frosty areas. The variety will no doubt replace Q.28 to a large degree on all soil types with the exception of wet lands.

Trojan was produced by the Colonial Sugar Refining Company in the Ingham district. Its excellent performances in that area are well known and at present this variety is creating an impression in the Burdekin. In the Mackay district, however, Trojan will not serve as a general-purpose cane and for maximum returns should be confined to the rich alluvial river flats and scrub pockets and to the older alluvial soils where irrigation is practised. Growers on the forest soils are well advised to forget Trojan, as it will definitely not produce crops to compare with Q.50, Q.28 and to a less extent with Q.45 and P.O.J.2878 on such soils. Trojan produces a slow but reliable germination, stools well, but early growth and cover is poor. Because of this characteristic this cane is better suited to autumn plant than to spring. The stick is weighty, above average barrel, with heavy hair growth and producing a sharply serrated leaf. Trojan is deceiving in weight and picks up heavily. This variety proved very tolerant to the 1946 frosts in the worst affected areas in the Mackay district and withstands flooding exceptionally well. The variety is reputed to be a late maturer but in past seasons has shown better than mill average c.c.s. from September on and the sugar content remains constant.

Trojan produces a good stool in ratoons but, as in plant cane, early growth is slow. Trojan, however, grows on in cooler weather when other canes have ceased and has not arrowed to date in this district. Trojan is recommended to growers on the better soil types where it will yield heavy tonnages and good sugar content and no doubt will find popularity along the O'Connell River, Mia Mia alluvial flats and numerous other minor localities.

Growers are naturally interested in the time of maturity of their crops in order to obtain maximum returns, and the result of maturity samples obtained from farm trials during 1947 are submitted here. The figures of course apply only to the one season but they will give growers some approximate guide as to the probable maturing period of the two canes. (See Table 2.)

TABLE 2.

SAMPLES OBTAINED FROM SANDY ALLUVIAL FARMS. 8 STICK SAMPLES—SMALL MILL.

Variety.	June.				August.				September.			
	Top.	Mid.	Butt.	Av.	Top.	Mid.	Butt.	Av.	Top.	Mid.	Butt.	Av.
No 1 Trial.—												
Q. 28	9·25	13·11	15·80	12·72	12·58	15·98	17·97	15·51	14·78	16·21	17·70	16·23
Q. 50	10·76	14·17	15·97	13·63	15·78	*15·78	18·80	16·79	17·35	18·10	18·79	18·08
Trojan	10·25	14·32	16·78	13·78	13·32	17·72	19·06	16·70	15·97	18·64	19·47	18·03
No. 2 Trial.—												
Q. 28	9·50	13·77	15·71	13·01	11·98	15·29	17·78	15·02	15·27	17·37	18·31	16·98
Q. 50	11·02	14·45	17·26	14·24	15·40	17·11	19·05	17·19	18·76	19·13	19·28	19·06
Trojan	11·05	14·60	17·34	14·33	13·44	16·34	18·85	16·21	16·12	18·13	19·49	17·91
No. 3 Trial.—												
Q. 28		Not ta	ken		12·77	16·25	16·88	15·30	15·35	17·24	17·50	16·70
Q. 50					13·82	16·38	17·12	15·77	17·67	18·52	18·51	18·23
Trojan					14·16	17·20	18·30	16·55	16·98	18·72	18·95	18·22
	SAMPLES OBTAINED FROM A SANDY FOREST FARM.											
No. 4 Farm.—												
Q. 28	9·24	13·10	15·18	12·50	10·80	14·22	17·20	14·07	14·14	15·02	17·00	15·39
Q. 50	10·37	12·80	15·94	13·04	13·41	16·14	16·98	15·51	16·92	*16·32	18·35	17·20
Trojan	10·24	13·53	15·96	13·38	10·74	15·03	17·74	14·50	14·57	16·93	18·91	16·80

* Red rot.

In summarizing the above table it can be seen that Q.50 had practically reached maturity in September, with Trojan showing high sugar content but not yet mature, while Q.28 appeared indefinite. Q.50 showed better than mill average in June but growers are not advised to look on this cane as early, as from June until September it showed an average increase of 3.9 c.c.s.

General Levy for 1948-49.

Since the establishment of the Bureau of Sugar Experiment Stations in Queensland in the year 1900 the assessment levy has been limited by the Sugar Experiment Stations Acts to a maximum of 1d. per ton of cane delivered to each mill in Queensland. This levy has been borne in equal parts by both miller and grower. As a result of the expansion of activities of the Bureau in recent years and of rising costs generally, a recent amendment to the Acts provide for a maximum levy in the future of 3d. per ton of cane. For the year 1948-49 the levy will be 2d. per ton of cane, payable in equal proportions by miller and grower.

N.J.K.

The Cane-killing Weeds.

By D. R. L. STEINDL and A. E. PEMBROKE.

History and Distribution.

PERIODICALLY minor outbreaks of the cane-killing weeds are recorded in Queensland cane fields and during the past year these pests have been observed in both the Mackay and Childers districts. In the former district they have been reported on a number of properties, and in some instances have caused severe losses in individual fields.

These weeds are known botanically as species of *Striga*, and are of particular interest inasmuch as they are members of the comparatively small group of flowering plants which are parasitic upon other plants. (Mistletoe and dodder are other examples.) They are fairly common throughout the tropics, occurring abundantly in tropical Africa, Egypt, Madagascar, Arabia, Ceylon, India, Siam, Java, China and Australia. The term "cane-killing weed" is a general term applied to the members of this group which are found parasitic upon the roots of sugar cane in Queensland.

FIG.1.—Portion of a circular patch in which the cane has been stunted and killed. Variety E.K.28.

In South Africa one species of *Striga*, commonly know as "witchweed," has been recognized as a serious parasite of the roots of maize. The witchweed has also been found as a parasite of sugar cane in Natal, but to a much less extent than on maize. In the Sudan another species is a serious parasite on sorghum, and also attacks maize and other grasses. *Striga* as a root parasite of cane was reported from India in 1921. During the course of investigations it was found that the parasite disappeared when the fields were rotated to cotton, and that therefore partial control had been unconsciously practised in the past. In 1928, a species of *Striga* was reported as causing considerable damage on one

sugar-cane estate in Mauritius. Specimens of *Striga* were collected early in the botanical history of Queensland and three species were included in an early catalogue of plants, at which time they appeared to be generally distributed over the State. The first record of these plants as parasites of cane in Queensland appears to have been in 1916 in the Degilbo district on the Gayndah line. In 1924 it was reported at Carmila, and since that time at least three varieties or species of the weed have been found in various parts of the Burdekin, Proserpine, Mackay, Bundaberg and Childers districts, sometimes causing serious damage to cane crops.

On several occasions the weeds have been found associated with wild grasses, but in no case was any apparent stunting produced. They are, therefore, an example of native parasites which have established a state of equilibrium with their native hosts, but this state of equilibrium has now been disturbed by the introduction of a new cultivated host plant which has proved susceptible and has allowed the parasite to gain the ascendency.

FIG. 2.—Showing severe stunting in a young field of Q.50 plant cane. Normal cane in background.

Appearance of the Disease.

Usually the areas of infection are roughly circular in shape, and extend up to several yards in diameter. However, on occasions the weeds will follow one row of cane for a considerable distance without appreciably affecting the rows on either side. The damage to the crop may range from an almost imperceptible stunting, in the case of very light infection, to very severe stunting and premature death of the cane (see Fig. 1). A heavily attacked field usually presents a very patchy appearance with saucer-shaped depressions scattered between patches of normal cane. In young cane the infected stools may be reduced to small grassy clumps with short stiff leaves (see Fig. 2), whilst in a typical case of infection in older cane the stools are markedly stunted with sparse tops and clinging trash. The stunted green leaves stand stiffly from the crown, and the more recently dead leaves tend to stand

out from the stem rather than hang loosely, while the older leaves hang stiffly down the stalk. The clinging trash may cause the production of aerial roots, but there are no visible symptoms within the stem, nor does the root system appear to be reduced to any appreciable extent.

During the summer the weeds may readily be found in clusters at or near the base of the cane stools (see Fig. 3) and to a lesser extent in the interspaces. If a stool and the associated weeds are dug up and the soil carefully washed away, the whitish parts of the parasite will readily be distinguished from the dark-brown roots of the cane. Both sets of roots are much intertwined, and on careful examination it will be seen that the roots of the parasite are attached to those of the cane by means of small cup-like swellings. The number of such attachments per weed may vary from one to many.

The weeds die in the autumn and assume a bluish-black colour. A careful search may be necessary before these inconspicious dried-out plants are found.

FIG. 3.—Showing clusters of the cane killing weed growing amongst stunted stools of cane.

Description of the Parasites.

As stated above, at least three distinct weeds have been found parasitic on cane in Queensland, but so far these have not been identified.

The chief differences are in flower, colour and habit, viz.:—

(*a*) Erect, flowers light blue or lilac.

(*b*) Trailing on the ground, flowers light pink.

(*c*) Erect, flowers light pink.

There is also an early record of a yellow flowering type. The general characteristics of the weed may be studied in Fig. 4. The plants vary in height from about nine inches to two feet. The above-ground stems

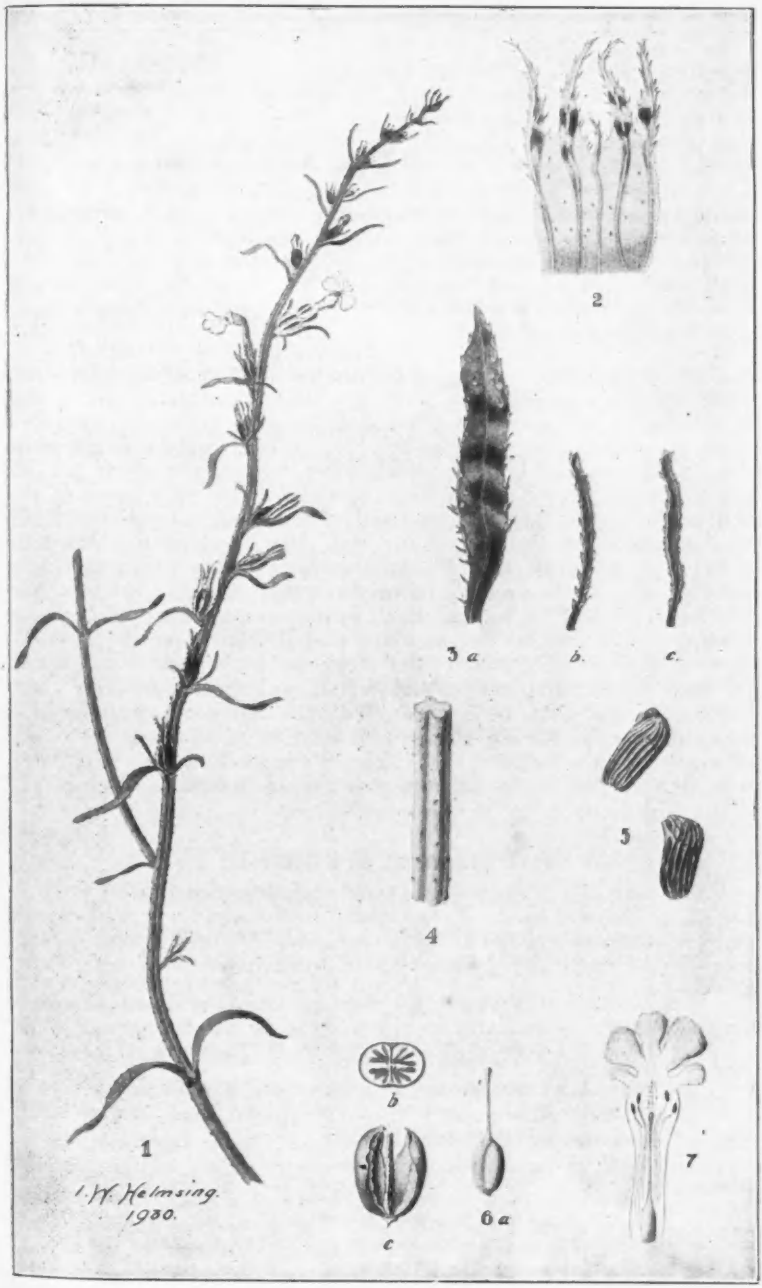

FIG. 4.—(1) Inflorescence, natural size. (2) Calyx, × 4; (3) *a*, Bract, *b* and *c*, bracteoles, × 4; (4) Portion of upper stem showing quadrified nature; (5) Seeds × 17; (6) *a*, capsule × 2, *b*, cross section of capsule × 4, *c*, empty capsule × 4; (7) Flower dissected to show floral parts, × 3.

are green, circular at the base, but becoming four-lobed in cross section higher up. The leaves are small, elongated and green, the lower ones being opposite each other, and the upper ones alternate. Both the leaves and stems are covered with small spines which make the plants rough to touch. When the plants are dried they become bluish-black in colour. The plants flower freely in late summer; the flowers are small, stemless, and have five petals, which may be pink, blue or yellow. The seeds are very small and light, and are produced in extremely large numbers. The underground portions of the stem are white or bluish, fleshy and branched, and bear pale scale-like leaves; the roots are light coloured and much branched and the rootlets bear root hairs, although they are not numerous.

The seeds mature and fall to the ground in autumn and early winter where they remain dormant until the following spring. Recent work in the Sudan has shown that the seeds will not germinate until they come in contact with excretions from the roots of certain plants, which need not necessarily be host plants. The roots of the young parasite grow through the soil and if they come in contact with the roots of a suitable host plant they produce small whitish spherical swellings which become attached to the roots of the host. Small outgrowths from these bodies then penetrate the root and enter its water-conducting tissues. During the first few weeks of its existence the parasite does not appear above ground, and the leaves remain whitish and undeveloped, but once the aerial shoots appear above ground they develop rapidly. The exact cause of the severe stunting of the parasitized cane plant is not known; the loss of water and plant foods sustained by the host is certainly partly responsible, but cane stools three feet high and growing under ideal conditions can be killed by a small number of weeds, the total dry weight of which would not exceed that of one or two cane leaves. It is, therefore, believed that the weeds must produce some substance which is toxic to the cane plant.

Transmission and Control.

The cane-killing weed is an annual and its one method of propagation is by means of seed. As mentioned previously, these are produced in very large numbers and are very small and light, and hence are easily carried by wind and by drainage or irrigation water.

It follows, then, that control measures must be directed towards the destruction of the plant before it seeds, or the destruction of the seed itself, and this may be accomplished by the following methods:—

(1) By chipping the weeds before they flower; this has to be done regularly, since the underground stems are constantly sending up fresh aerial shoots.

(2) In the Central Provinces, India, successful control of the weeds has been obtained by the use of a two or three percent. solution of copper sulphate. The solution is supplied to each clump of weeds in sufficient quantity to soak the soil around the plants to a depth of two to three inches. One application is claimed to eradicate the weeds, and the cane will then resume its normal growth.

(3) Recent work by the Bureau indicates that satisfactory control can be obtained by the use of the recently developed "hormone" weed-killers, such as "Hormex," 2:4 Di-weed and Hardy's 2:4-D. Single sprayings of the recommended strengths of these selective weedicides completely killed the weeds, including the underground portions, without affecting the cane, and observations to date show that the cane is recovering from the effect of the parasites. If the weeds are watched for and sprayed in their early stages of growth very little damage to the cane should result.

(4) If the plants have seeded before they are discovered, the burning of trash will assist in killing all seeds above or on the surface of the ground.

(5) Fallowing the land and growing green manure crops will rid the soil of most seeds. It has been found in the Sudan that the root excretions of many legumes will stimulate the germination of *Striga* seeds. In some cases the young seedlings die through the absence of suitable host roots, while in others they are able to live as feeble parasites on the legumes; however, on these plants they seldom form above-ground shoots, and never produce seed. By inducing germination the legumes thus clear the soil of seeds more quickly than a bare fallow.

Practically all recent outbreaks of the cane-killing weeds have been on new lands, or land which has been under pasture for a number of years. This suggests that the normal agricultural routine of cane growing tends to eliminate the pest from cultivations, and that the weeds can increase only when the land reverts to pasture grasses.

Cane Samples for Small Mill Tests.

It has been the practice of the Bureau to accept cane samples from canegrowers for the purpose of determining the state of maturity of their crops, and thus giving an indication of the sequence in which respective blocks should be cut.

Of recent times, many of the samples which have been submitted are totally worthless for the purpose, and we would remind growers that unless the following requirements are complied with, samples will not be tested.

The sample shall consist of six stalks or 20 lb. of cane, whichever is the greater. Samples of burnt cane will not be accepted in any circumstances. When samples are forwarded over the railway, freights must be pre-paid.

We would again remind growers of the true purpose of these tests, and make it quite clear that our results are not intended for use in checking mill returns.

N.J.K.

Can Downy-mildew Disease be Eradicated in Queensland?

BY NORMAN J. KING.

THERE is little doubt that the serious disease of sugar cane known as downy mildew was introduced to this country by importations of sugar-cane cuttings from abroad, and its introduction probably took place late in the last century. An outbreak of a "new" disease on the Herbert River in 1901 was probably downy mildew, but in 1910 it was definitely known to exist throughout the northern and central districts. Although recognized as a serious disease of sugar cane no particular steps for its control were inaugurated except selection of clean plants. It was not until 1935 that active measures were taken in an attempt to control the disease in what was then the most seriously affected district—the Lower Burdekin area. Here B.208 was so badly diseased that it was stated that no field of that variety could be considered to be clean. It was decided that the only chance of controlling the disease was the elimination of B.208 and this variety was accordingly removed from the approved list published in the Local Award in 1936 for the Inkerman, Kalamia and Pioneer mill areas. After the lapse of several years, during which time all B.208 was ploughed out and other varieties inspected and rogued, it was considered that the disease was eradicated, and as a result of applications for the reintroduction of B.208 the variety was once more established and was added to the approved lists between 1944 and 1946.

Mulgrave and Mossman Mill Areas.

Almost simultaneously in 1937 downy-mildew disease began to cause concern in these two districts and it was also known to exist in the Hambledon area at the same time. The disease was not a newcomer to the districts but had been perpetuated in odd fields of susceptible varieties and showed a tendency to develop to serious proportions with the release of any susceptible variety. In Mossman in particular P.O.J.2878 provided a suitable host plant for the spread of downy mildew, while in the three areas such canes as Pompey, B.147, D.1155 and Q.2 were sufficiently susceptible to keep the disease in existence. In none of the districts was the position sufficient serious to warrant disapproval of susceptible varieties, as by this time local Cane Pest and Disease Control Boards had been constituted and the respective supervisors, by careful inspections and roguing, were gradually able to eliminate the disease. It cannot be stated definitely that the Mossman area is quite free of downy mildew until a couple more years of freedom are experienced.

Mackay Area.

In the central district similar conditions obtained in respect of the presence of downy mildew but the standard varieties being grown were of such resistance or tolerance as to prevent the disease attaining epidemic proportions. The widespread planting of the highly susceptible P.O.J.2878 between 1934 and 1938 combined with the increasing areas of P.O.J.2714 caused rapid spread and heavier incidence of the disease. By 1937 it was obvious that some drastic action was required if the variety were to be saved at all and accordingly both P.O.J.2714 and P.O.J.2878 were eliminated from the approved lists in the 1938 Local

Awards except for the Plane Creek area, which had remained disease free, and certain outlying parishes to which the disease had not yet spread. The wisdom of the course was made evident by the rate at which downy mildew continued to spread in the existing fields of P.O.J.2878. In 1939 a supervisor and assistants were appointed by the newly constituted Cane Pest and Disease Control Board and during 1940 14,529 diseased stools were dug out of 222 farms. P.O.J.2878 fields were being ploughed out, both on account of age and as a result of plough-out orders, and consequently two years later the number of diseased stools found amounted to only 87. In 1944 no disease was found and the entire district has been apparently free since that time. P.O.J.2878 was added to the approved variety lists in 1944 and this valuable variety can now be grown in any part of the Mackay area without fear of losses as a result of downy mildew disease.

Bundaberg Area.

In this district, the only one of the southern areas to become infected with downy mildew, the disease was known to exist in the Kanaka days. Apparently the discarding of many of the older susceptible varieties led to a commercial control of the disease but it had never died out completely. Subsequent to 1933 the variety P.O.J.2878 and, to a lesser extent, P.O.J.213 were planted up on a very large scale and both, by virtue of their susceptibility, became badly infected with downy mildew in the Woongarra and South Kolan areas as well as at South Bingera, Givelda and Gin Gin. In 1938 the position had deteriorated to such an extent that the District Executive, in collaboration with the Bureau, inaugurated an inspection and roguing service in an attempt to control the disease. The following year a Disease Control Board was constituted for the control of both downy-mildew and Fiji diseases, and inspectors and assistants were appointed. A vigorous campaign of inspection and stool destruction followed, supplemented by plough-out and harvest orders issued by the Bureau. Simultaneously the growing of maize was prohibited in the affected areas, but downy mildew was by this time firmly established and the task of eradication was rendered much more difficult by the fact that suitable resistant varieties were not available to replace the P.O.J.2878. The elimination of this variety from the approved list would have involved considerable hardship to Bundaberg growers and it was decided that, for the time being, an attempt should be made to clean up the disease by less drastic methods. Since that time the disease has been eradicated from all districts except the Woongarra and here it has been reduced to a stage which is probably the best possible with the control methods now in operation. The table below indicates the stools eradicated each year for the whole Bundaberg district.

Year.	Downy mildew stools eradicated.	Year.	Downy mildew stools eradicated.
1938	4,233	1943	1,650
1939	12,581	1944	4,008
1940	13,235	1945	1,406
1941	3,734	1946	5,270
1942	999	1947	1,801

The figures indicate that the spread was arrested by 1941 and that since then the stools found have fluctuated between one thousand and five thousand due to seasonal conditions and occasional bad blocks in which an intensity of infection had built up before the inspectors detected it.

In the past two years a rapid alteration in the varietal position has developed in the affected area. C.P.29/116 and Q.49, both resistant to downy mildew, have replaced large areas of P.O.J.2878 and the acreage of the latter cane is now lower than in any year since downy mildew developed on a large scale. The Woongarra area is now the sole stronghold of this disease in Queensland and a concerted effort on the part of all growers in this area would undoubtedly result in complete eradication. A state of freedom from this serious menace is possible and practicable in a short time by replacing the comparatively small acreage of P.O.J.2878 with the resistant varieties now available. It is perhaps not generally appreciated that, if the district were free from downy mildew, more new varieties could be released. At the present time all new seedling varieties of promise are subjected to downy-mildew trials and those which are susceptible are not released for planting within the area. Further, the variety Trojan is very susceptible to the disease and could not be considered as an approved variety in the Woongarra so long as downy mildew exists there.

The foregoing is a history of the measures adopted for dealing with this disease in Queensland. In the period of twelve years since the problem was tackled in the Burdekin the disease has been progressively eliminated in every district except the Woongarra section of Bundaberg. It is interesting at this stage to recall the words spoken by Mr. A. F. Bell on the occasion of a Technologists' Conference at Mackay in 1940. The title of the address was, "Downy Mildew, Queensland's Most Important Sugar Cane Disease." Mr. Bell said—"Standards change; ten years ago downy mildew was regarded as a disease of very minor importance, and scarcely entered into our calculations, while to-day it is a problem in almost every sugar-cane-growing district of Queensland." The decade 1930-1940 was obviously one of deterioration insofar as this disease was concerned, but the improvement attained since then makes us hopeful that by 1950 we can say with surety, "Downy mildew is no longer a disease of sugar cane in Queensland."

Field Days.

During the months of May and June the annual Field Days were held at Meringa, Mackay and Bundaberg Sugar Experiment Stations. Good attendances were recorded at all places and each Field Day was an outstanding success although at Meringa the weather conditions were threatening and no doubt debarred many intending visitors from travelling from more distant areas. Visiting growers and other industry representatives expressed interest in and appreciation of the work being carried out on the Stations. A full description of the functions will appear in the October number of the Quarterly Bulletin.

N.J.K.

Two Promising Legumes in North Queensland.

By E. V. HUMPHRY.

DURING recent years many of the standard leguminous green-manure crops in North Queensland have failed due to a disease known as "wilt." The organisms which cause this disease increase in the soil where the crop is regularly grown until at length it becomes impossible to grow any plants which are susceptible to the wilt in that soil. Among the legume crops which have become affected Poona pea is highly susceptible, whilst in areas where wilt has become bad even Giant Cowpea, which has been regarded as moderately resistant, cannot now be grown successfully during a wet year.

FIG. 5.—Cristaudo pea on left. Giant cowpea on right.

Two new legumes, namely, Cristaudo pea* and Reeves' Selection, are showing promise of being wilt resistant in North Queensland, even when grown on low land under very wet conditions.

The original seed of Cristaudo pea was obtained from Ingham some years ago, when it was referred to as Ingham pea. This plant may be used as a substitute for Giant Cowpea and Poona pea, especially on the lower soils which become very wet in the rainy season and where these two varieties, in particular Poona pea, are badly affected by wilt. Cris-

* Cristaudo pea has lavender-coloured flowers. The colour of the wing petals is slightly darker than the standard, and the keel is white. The back of the standard is a yellowish colour, whilst the sepals are shorter than those on Poona pea flowers. The average length of the pods is approximately 7 inches, that is, intermediate between Poona pea and Giant Cowpea pods. Cristaudo pea seeds are larger than those of Poona pea but not as large as Giant Cowpea seeds. They range in colour from a purplish brown to cream with the latter colour predominating. Cristaudo pea resembles Poona pea in its early stages but grows more rapidly into a bigger plant. It is a trailing type of legume and sends out runners up to 10 to 12 feet long.

taudo pea is resistant to both bean-fly attack and wilt, and has performed remarkably well under both wet and dry conditions in several trials. In one trial this pea has produced an excellent cover crop on low grey wet soils, whilst Giant Cowpea and Poona pea in the same trial have died of wilt. Only an odd plant of Cristaudo pea wilted in the extremely wet patches. The accompanying photograph (Fig. 5) shows the difference in growth and cover provided by well-grown wilt-resistant Cristaudo pea on the left, and small stunted plants of Giant Cowpea on the right. Poona pea planted as a nurse crop with Giant Cowpea has been destroyed by wilt.

The seed was not inoculated before planting, but large numbers of *Rhizobium* nodules had developed along the roots of every plant inspected, thus ensuring "fixation" of atmospheric nitrogen to increase the supply of nitrogen in the soil.

FIG. 6.—Giant cowpea on left. Reeves' Selection on right.

As this crop makes good early growth there is no need for a nurse crop, as is the case with Giant Cowpea; however, it is a sound idea to plant it with a light crop of sorghum to provide support for the runners. The variety seeds prolifically and is comparatively easy to harvest. The seed is small and a given weight of Cristaudo pea seed will plant about three times the area which the same weight of Giant Cowpea would plant. These factors should make it a comparatively cheap crop to grow. With a growth period of approximately five months this variety commences to seed after about two months. Even after seeding, however, it continues to send out runners and make further growth.

In addition to observations at the Experiment Station at Meringa, Cristaudo pea has been noticed growing excellently on the farm of A. Lyons at Jungara, who obtained his original seed from the C.S.R. Company. Through Mr. Lyons's courtesy sufficient seed was harvested to enable large areas to be planted at Meringa for observation purposes.

Reeves' Selection† (also known as Q.1582) is the other new variety which has shown promise as being suitable for low land where Poona pea is usually destroyed by wilt. Reeves' Selection is resistant to wilt but slightly susceptible to bean fly attack, though no more so than Poona pea. It makes good early growth, has a growing period of approximately four months, which is slightly longer than Poona pea, and commences to seed about three months from the time of planting. In trials similar to those carried out with Cristaudo pea, Reeves' Selection proved itself a better legume than either Poona pea or Giant Cowpea when grown under wet conditions. Poona pea was destroyed by wilt and only a few stunted Giant Cowpeas remained growing in the vicinity of the plot of Reeves' Selection which has produced an excellent cover crop, whilst large numbers of *Rhizobium* nodules have been found along the roots of all the plants inspected. Fig. 6 shows Reeves' Selection on the right, and Giant Cowpea on the left. This variety should also be a reasonably cheap crop to grow; it seeds fairly freely, and the seed is only slightly larger than Poona pea seed.

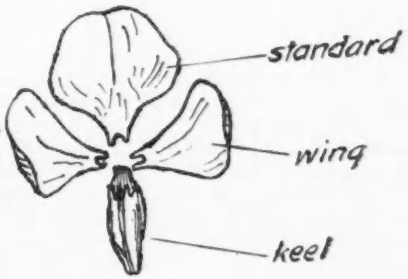

FIG. 7.—Showing parts of the pea flower.

Arrangements have been made for the propagation of these legumes and there should be a fair amount of seed (at least of Cristaudo pea) available in North Queensland for sowing at the end of 1948.

† Reeves' Selection has flowers with the standard and wing petals of a bluish colour, with a tinge of lavender towards the base. The back of the standard is a creamy-yellow colour and the keel is white. The sepals are somewhat longer than those on Poona pea flowers. In comparison, Poona pea flowers are a darker lavender, and the colour of the petals is more uniform. The colour of the wings is slightly darker than the standard, whilst the back of the standard is a pale lavender colour and the keel is white. Pods of Reeves' Selection are about 5 inches long, that is, slightly shorter than Poona pea pods, but very similar. The seeds of Reeves' Selection are darker in colour and slightly longer and rounder than Poona pea seeds. In growth Reeves' Selection somewhat resembles Poona pea. The plants are alike but Reeves' Selection does not grow as upright as Poona pea and sends out runners up to about 4 feet in length.

Mackay Varietal Changes from 1933 to 1947.

By J. T. ELLIOTT.

VARIETAL changes in the Mackay-Proserpine district for the period 1933 to 1944 were discussed in the 1945 Annual Report of the Bureau of Sugar Experiment Stations. During that period there was no spectacular revolution as was the case in South Queensland; however, during the past four years the varietal position has changed so completely that the subject is considered worthy of comment at the present time.

The Mackay-Proserpine district comprises eight mills and produces approximately one-quarter of the State's annual cane crop. The area extends from Proserpine in the north to Carmila in the south and reaches as far as 40 miles inland.

When discussing varieties with the older growers of the district, one is constantly reminded of one or other varieties that has given excellent results in some particular locality and it would be surmised that varieties have come and gone rapidly in recent years. However, statistics show that this has not been the case insofar as the major varieties are concerned.

Examination of the accompanying diagram (Fig. 8) reveals that over the period 1933-1943 there were four varieties—namely, M.1900 seedling, E.K.28, H.Q.426 and Badila—which constituted between 70 and 80 per cent. of the total crop for the whole of that time. During the early and mid thirties Q.813 and P.O.J.2714 were of some importance, but these varieties, together with a number of lesser ones, were gradually replaced by S.J.2, P.O.J.2878 and Co.290. M.1900 seedling was the major cane of the district during this period and is represented by a broad strip through the centre of the diagram. It reached its maximum in 1936 when it constituted 46 per cent. of the crop. This cane can be classified as the "Badila" of the forest soils of Mackay; it has certainly meant almost as much to the district as Badila has to the fertile soils from the Burdekin north.

A marked transformation in the varietal position commenced in 1944 when Q.28, which was produced on the Mackay Experiment Station, made its appearance. In 1943 this variety composed only a meagre 0·3 per cent. of the harvested crop but all available planting material was further propagated. In 1945 Q.28 was the major crop with 28·9 per cent. of the district cane crop, or 5·9 per cent. more than M.1900 seedling. Not only did it predominate in the district, but in 1946 it rose to the coveted position of No. 2 for the whole State, Badila, of course, holding pride of place. By 1947 Q.28 had reached 50·6 per cent. of the total crop for the district and has probably reached its maximum.

This phenomenal increase was made mainly at the expence of M.1900, and as both canes are better adapted to the forest soils, which predominate in the district, the decline of M.1900 is understandable. Other canes affected were Co.290, which had risen to almost 17 per cent. of the total crop in 1944, H.Q.426 and, to a lesser extent, E.K.28.

Unlike other areas, the Mackay district did not lose any major variety due to the incidence of disease. P.O.J.2878, due to its susceptibility to downy-mildew disease, was removed from the approved list in some areas for a few years, but this particular cane, at the time, was

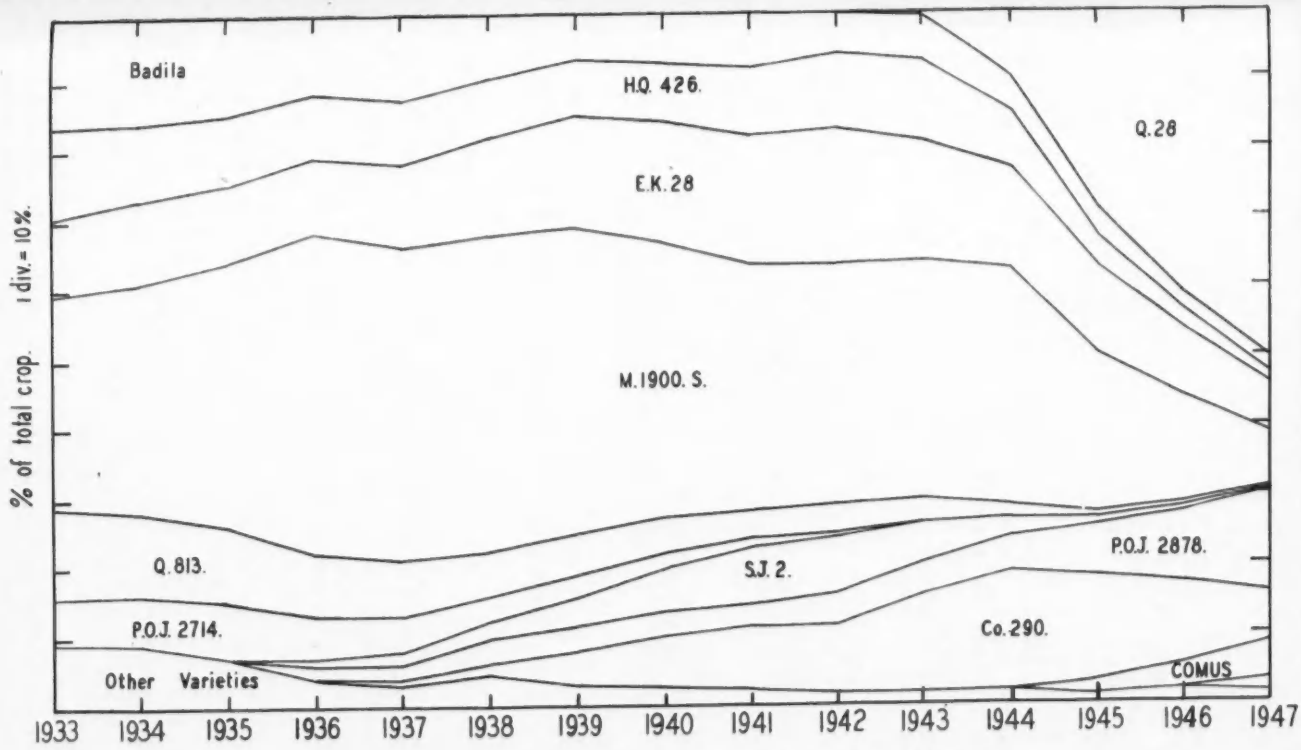

FIG. 8.—Illustrating varietal changes in the Mackay district from 1933 to 1947.

only gaining popularity and had not reached a prominent position. However, since its general approval in 1944 it has gradually increased in popularity and in 1947 produced 14·3 per cent. of the total crop, being second only to Q.28.

Comus and Q.45, the latter being represented by the small wedge in the bottom right-hand corner of the diagram, are also increasing in popularity but it is not expected that they will go very far. P.O.J.2714 has disappeared, while Q.813 and S.J.2 together now occupy less than one per cent. of the crop.

It is interesting to observe that in 1937 M.1900 seedling, E.K.28, H.Q.426, Badila, Q.813 and P.O.J.2714 made up 92 per cent. of the crop, whilst in 1947 their total was only 19 per cent. On the other hand the varieties Q.28, P.O.J. 2878, Co. 290, Comus, and Q.45 constituted approximately 80 per cent. of the crop for 1947 whereas in 1937 they were only represented by P.O.J. 2878 and Co. 290 which together totalled 3 per cent.

No doubt the next few seasons will witness an equally great revolution as a new star, namely Q.50, appears destined to illuminate the Mackay varietal horizon. On present performances it is certain to replace much Q.28 and force a further decline of the old standards of the past. Perhaps Q.50 will make an even more spectacular rise to fame than that performed by Q.28 during the period 1943-1947.

How Long Should Setts Be?

By C. G. HUGHES.

ARGUMENTS are frequent among farmers as to the best length of setts to plant and, whilst not attempting to answer all the questions, the author feels that some notes on our present knowledge concerning lengths for particular conditions would not be out of place. It is not intended to discuss the wider problem of how much cane per acre should be planted, but it has to be borne in mind that the farmer doesn't want to have to pay for cane which is not going to produce stools. Conditions which result in the ends of long setts coming out of the ground and those causing the rotting of setts through pineapple disease often give the farmer furiously to think whether he is using the right length of sett.

The three-eye sett is generally regarded as the most desirable plant and naturally the length of it will depend on how far apart the buds are on the stick, i.e., the length of the internodes. In well-grown, succulent cane of the taller varieties, such as P.O.J.2878, Eros and E.K.28, a three-eye sett may be two and a half feet in length or even longer. Some time after such long setts are planted, but usually before much germination has occurred, the farmer will observe that many of the setts have bent and one or both ends are sticking out of the ground, with a consequent

exposure of the end buds. Besides the death of these buds, there is the fact that the curved setts interfere with weeding operations, and may frequently be pulled right out of the ground by the hoe. Some farmers are inclined to put on extra cover to counteract this tendency of the setts to rise out of the soil. The extra cover does certainly prevent this to some extent, but even then the bend may be sufficient to bring the ends of many setts close to the surface, where they may be damaged by implements, and, besides, the cover may cause loss of germination in the deeper buds. It is of interest to note that the sett does not bend out of the ground by a general curving of the whole piece, as occurs when a piece of wood is exposed to moisture on one side, and that the drying out of the surface soil has nothing to do with the bending. Just above, or level with, the top of every bud on a stick of cane there is a band of smooth tissue, extending right around the stalk and usually one-sixteenth to one-eighth of an inch in width. This is the "growth

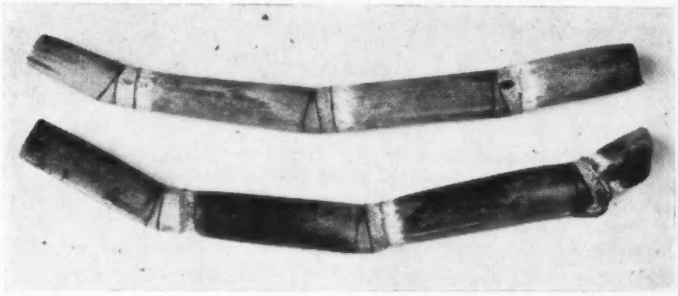

FIG. 9.—Showing setts bent by uneven expansion of growth rings.

ring" which in a stick growing in a vertical position is much the same width all round, but when the cane is lodged and the top portion starts to stand up again it will be observed that the growth rings in the younger part of the stem are now wider on one side than the other, i.e., they have expanded on one side only and so pushed adjacent internodes out of a straight line and towards the vertical (see Fig. 9). This growth in the rings will occur only in the comparatively young portion of the cane—one has only to recall the picture of a lodged crop to know that the mature cane is on the ground or parallel to it, but the younger portion has grown through a right angle, and is upright again. This tendency to resume the vertical will still persist when the young cane is cut into setts and planted. The disadvantages of the very long sett, which will bend out of the ground, are obvious and the question arises as to whether three-eye setts are necessary under these conditions. The answer is that they are not necessary and, providing conditions for germination are reasonably satisfactory, there is no reason why, say, six buds should not be distributed over three or even more setts. Under normal conditions a bud in a single-eye sett will germinate just as well as one on a sett with several buds.

The question of length of sett also crops up in certain areas, such as Down River at Inkerman, where germination is likely to be reduced, often to the point of complete failure, by fungi from the soil invading the cut ends of the setts and rotting them before the buds can germinate (Fig. 10). Some farmers have reasoned that a very long sett, usually containing a dozen or so buds, would allow some of the buds to germinate before the fungus had time to reach them. However, these fungi, of which that causing pineapple disease is one of the most destructive, can advance through a sett in the ground very quickly and it is doubtful whether even a very long sett would delay them

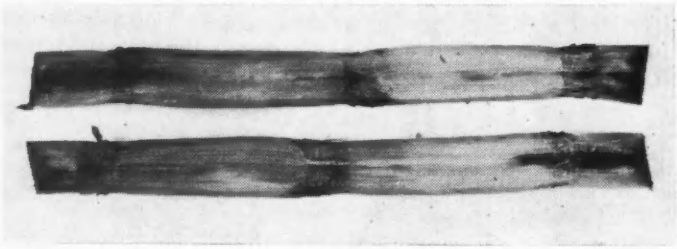

FIG. 10.—Showing invasion of sett of Q.52 by the pineapple disease fungus from the soil. The ends of the sett are black with the fungus.

sufficiently to allow any of the buds to grow, if conditions were at all favourable for the rotting organism. In addition to the effect of the fungi, the effect of the buds of a multi-eye sett on each other has to be considered. Work in Hawaii and extensive observations here have shown that this effect is real and marked. The few buds towards the top end of such a long sett will germinate first and the remaining buds will then either not grow at all, or else produce very backward shoots, which will later be crowded out. The net conclusion, then, is that the excess buds on the long sett are wasted and that shorter setts would effect a considerable saving in cane used for plants. To make certain that the fungi do not harm the shorter setts, all plants should be given a short dip in a solution of a mercurial preparation, full particulars of which may be obtained from the nearest Bureau field officer.

The Use of "Gammexane" in Controlling "White Grubs" in Queensland Canefields.*

By R. W. MUNGOMERY.

Introduction.

ALTHOUGH benzene hexachloride was discovered by Michael Faraday in 1825, it was not until the early years of World War II that this chemical was found to have potent insecticidal properties.

Slade [1] and Homes [2] related how at that time stocks of certain insecticides, such as derris and pyrethrum, were fast becoming depleted in Great Britain, with no prospect of supplies being replenished in the near future. British scientists were immediately assigned to the task of discovering suitable substitutes which could be readily produced in that country and which would give adequate protection to the crops that were so vitally needed for home consumption. It is certainly a very true and time-proven adage that "necessity is the mother of invention." for it was largely as a result of this dire necessity and due to concerted efforts of these brilliant scientists that the gamma isomer of benzene hexachloride was shown to be extremely toxic to a number of destructive insect pests. Another most important consideration was that it was able to replace certain insecticides which by then had almost vanished from the British market. Following on this outstanding discovery this compound was first utilized on a large scale for the control of the turnip flea beetle, *Phyllotreta* sp., in which rôle it proved completely successful Later, it was demonstrated that the use of gamma benzene hexachloride could be extended to control such household pests as flies, mosquitoes, cockroaches, bed bugs, &c., whilst from early indications in tests against wireworms it was also suggested that it might possess considerable merit in preventing damage by these pests which frequently prove troblesome to cereal crops in Britain.

Exploratory Trials.

The first supplies of benzene hexachloride for experimental work against cane beetles and grubs in Queensland were received in the latter part of 1945 when a 10 per cent. proprietary dust (1.3 per cent. gamma isomer) and a mayonnaise-type emulsion under the general trade name "Gammexane" were made available. These stocks were small and consequently the amount of investigational work that could be undertaken was distinctly limited. Morover, as far as could be ascertained, no previous work against "white grubs" had been undertaken with this new insecticide, or, at least, no results of any similar investigational work were then available, such as might serve as a guide in carrying out the necessary preliminary tests against these pests. However, it was soon found that gamma benezene hexachloride was extremely toxic to the grey-back cane beetle (*Dermolepida albohirtum* Waterh.) in both the larval and adult forms and that it required a concentration of only one part per million of soil to effect a kill of either of these stages.

Prior to this, a small exploratory field trial had been set out in a block of June plant cane in which applications of the 10 per cent. dust were made early in November, 1945, at rates of 100 lb. and 400 lb. per

* Paper presented at the Maryborough Conference, Q.S.S.C.T., April, 1948.

acre. These were somewhat arbitrary, but when deciding on these dosages in the first place cognizance was taken of the probable cost per lb. of this dust and the maximum quantity that might be applied per acre as an economic proposition in Queensland canefields. The block selected was on the Meringa Sugar Experiment Station and was growing a forward crop of Badila cane. Judged in the light of the past history of infestations in that locality, it was considered highly probable that the crop would become heavily grub infested should weather conditions favour grub survival. It was presumed that the insecticide would have to be well worked into the soil to achieve best results. Accordingly, the dust was applied to the planting furrows and lightly hoed in so as to cover it and mix it with the soil near the base of the cane stools. Subsequent implement cultivations mixed the dust more intimately, and later, in accordance with customary practice, the surface of the field was worked to a more or less level condition. Bettle emergences occurred towards the end of December, 1945, some seven weeks later, and the grub infestations that resulted were some of the heaviest and most extensive on record. The block in which the trial was located carried large grub populations, some of the areas occupied by individual stools harbouring as many as fourteen. Progress diggings revealed that the grubs became sickly and died as soon as they moved in from the interspaces and came in contact with the toxic zone of soil surrounding the base of the cane stools.

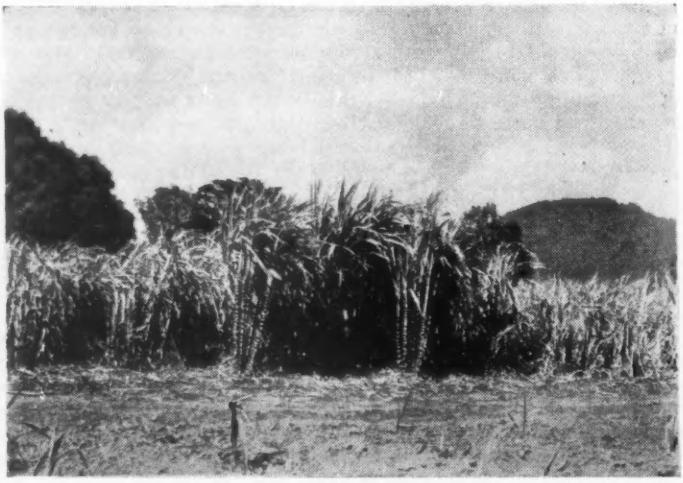

FIG. 11.—View of experimental plot, September, 1946. The three wellgrown rows of Badila cane (centre) were treated with benzene hexachloride; untreated rows on either side.

When final diggings were made towards the end of April, 1946, some rather startling results were obtained. It was found that an average of between five and six large third-stage grubs were present under each stool in the untreated control rows, whereas virtually complete control was obtained in both the areas treated with gamma benzene hexachloride. In this instance the treated plots stood out green and showed four to five

feet of good stocky Badila cane which was still growing, whereas in marked contrast the control plots showed the typical dead leaves of a grub-smitten crop with only two to four feet of cane and tops badly pinched out (Fig. 11). Encouraging results were also obtained in a simliar trial in Badila ratoons. In this instance the benzene hexachloride dust was applied in furrows ploughed away from each side of the row of cane, but on account of the lower infestation encountered in this field the visible effect was by no means so striking. Infestation in the untreated control plots averaged 2.2 grubs per stool, whilst in the rows treated with benzene hexachloride the surviving grub population averaged only 0.1 per stool.

It became apparent from these exploratory trials that, under certain conditions, benzene hexachloride would no doubt kill cane grubs even when applied to the soil in relatively small quantities. Morever, its application to the soil did not involve the unpleasant conditions associated with the use of carbon disulphide—the then standard fumigant used for controlling cane grubs. It was indicated at that time that the cost of the crude benzene hexachloride was likely to be in the vicinity of 4s. per lb. Recent quotations have verified this earlier estimate, and the price of the 10 per cent. dust has since been fixed at 10d. to 1s. per lb. On this basis, therefore, the cost of soil treatment with this new insecticide was likely to become an attractive proposition when compared with the more costly carbon disulphide fumigation. The use of carbon disulphide also involved another serious drawback, namely, its application at some period during a lull in the normal monsoonal rains; hence this method did not always give effective control.

Further Experiments.

Many interested growers either witnessed or became aware of the results of these early experiments, and as a result there was an immediate and somewhat embarrassing demand for supplies of this new insecticide, even though the information that had been obtained at that time was still rather meagre. It was embarrassing because on the other side of the picture were a number of questions that had to be answered satisfactorily before the use of benzene hexachloride could be advocated. The chief one was to ascertain if this material were toxic to either cane or any of the legumes that are commonly grown as green manure crops. Although cane already established in the field had shown no apparent ill effects from substantial applications of benzene hexachloride, the growth of cane from setts planted in pots of treated soil under glasshouse conditions had shown a depressing effect proportional to the concentration of benzene hexachloride in the soil. In consequence, a number of phytotoxicity trials were immediately set out in most of the sugar-growing districts of Queensland, and these plots subsequently encountered conditions ranging from a severe drought in the Mulgrave area to excellent growing conditions in the irrigated fields of the Burdekin. Rates of application in these experiments varied up to 600 lb., and in a few instances to 1,000 lbs., of 10 per cent. dust per acre. Despite these comparatively heavy rates of application, no noticeable stunting was visible in the field in either the cane or the legume crops. This was confirmed later by the results of a trial set out in the South Johnstone area during the 1946-47 grub season when an attempt was made to evaluate the relative effectiveness of three different dosage levels of benzine hexachloride when compared with the standard carbon disulphide treatment for cane-grub control.

Unfortunately, this trial did not become grub infested, but it was decided to harvest the plots in order to ascertain if any of the treatments disclosed any phytotoxic effects. The results of this trial are detailed in Table I.

TABLE 1.

SUMMARY OF YIELDS OF CANE IN TOXICITY TESTS.

Treatments.	lb. benzene hexachloride (10 per cent.) per acre.			CS, approx. 200 lb. per acre.	Check.
	100	150	200		
Cane, tons per acre	26·66	24·82	25·74	25·13	24·65
Cane, percentage mean yield ..	105·0	97·7	101·3	99·0	97·1

Owing to variations in individual plot yields, the differences recorded above are found to be due to chance alone, and not to the insecticides under test, i.e., there was no toxicity effect.

Further, in the Innisfail area where 150 lb. of 10 per cent. benzene hexachloride dust was applied broadcast to different fields and intimately mixed with the soil, excellent germinations resulted in both the treated and untreated areas. In a similar experiment in the Isis district, germinations in the treated area did not in any way suffer by comparison with those in the untreated areas.

In addition the various isomers were tested separately and none was found to be particularly toxic. Since there is a certain amount of evidence that the insecticidal effect of gamma benzene hexachloride when mixed with soil may persist for a considerable period, it is unlikely that future applications in the same field would have to be on such a scale as to cause the accumulation of any toxic substance included as an impurity in the crude product.

Other points that required elucidation were the minimum quantities required per acre on different types of soil for effective grub control, the latest period when benzene hexachloride could be worked into the soil and still prove effective, and whether it would be satisfactory to apply it after a particular field was known to be grub infested. To this end, an extensive series of trials involving different dosage rates and times of application was set out during the 1946-47 season in a number of fields where it was expected grub infestations would be substantial. The selected areas embraced districts from Mossman to Mackay. However, droughty conditions throughout the whole of this belt so curtailed beetle emergences or caused desiccation of the eggs and young grubs that grub infestations in 1947 were the lightest on record. Hence it was only with difficulty that light or moderate infestations could be located. Some trials had to be abandoned, whilst the later treatments planned for others had to be transferred to more promising sites. However, some useful information was ultimately gleaned from them. For best results indications pointed to the desirability of applying the material to the cane rows one or two months *before* the anticipated beetle flight. There was some partial control when the dust was applied a month *after* the beetle flight, but in some cases the damage ultimately inflicted by grubs was sufficiently

severe to make this practice undesirable except on the heavier and alluvial soils. In this connection it should be remembered that wet conditions at this period or the greater height of the cane are two factors likely to limit the cultivation operations which are required for the thorough mixing of the insecticide with the surface soil. Hence they may prejudice the success of any such undertaking, and presumably this form of control would be undertaken only as a matter of expediency.

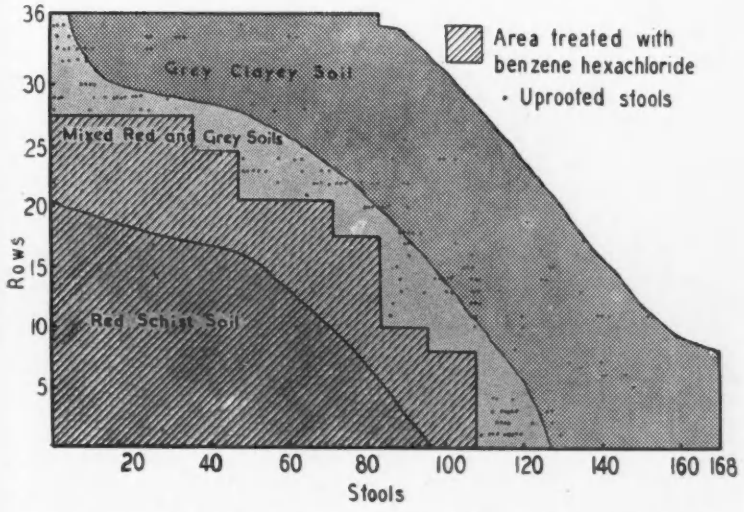

FIG. 12.—Plan of experimental block on Meringa Sugar Experiment Station, July, 1947.

The dosage rate of 100 lb. of 10 per cent. dust per acre was found effective in all areas when applied in the cane furrows one to two months before beetle emergence, and until further experiments have established more definitely the quantities required for different soil types, this is the recommended amount for grey-back grub control. It is probable that 75 lb. per acre may prove effective in some cases, whilst 50 lb. may prove sufficient for the heavier clays and alluvials, but these amounts still need confirmation. The effectiveness of the 100 lb. per acre rate was again demonstrated in a block of seedling canes on the Meringa Sugar Experiment Station in 1947. The block in question exhibits considerable variation, ranging from a definite red schist soil on the south-west to a heavy grey clayey soil on the north-east. Between these two types and merging into them is a brownish soil which is really a mixture of the two (Fig. 12). From previous experience with grub attack on this property, it was considered that the red-soil portion of the block was the most likely to become grub infested and, since supplies were limited, only this soil and part of the adjacent brown soil was treated with benzene hexachloride, as shown on the plan in Fig. 12.

In July, 1947, grub damage became apparent in the portion immediately outside the treated area. Accordingly, the positions of damaged cane stools were noted, and have been plotted in Fig. 12. It will be observed that the uprooted stools were restricted to the untreated area.

In addition, there were other stools which were stunted, yellow, and obviously grub affected, but none of these occurred in the treated area. The photograph in Fig. 13 also serves to illustrate the state of the cane in the treated and untreated areas. Incidentally, grub damage showed up very clearly in similar red soil on an adjacent block and also on neighbouring farms, so that it could not be contended that the red soil in this block had escaped infestation or that, apart from the application of benzene hexachloride, it had otherwise been unfavourable for grub development.

FIG. 13.—View of portion of the area shown in Fig. 12. On left cane treated with benzene hexachloride; on right untreated area showing lodged and uprooted stools.

Effectiveness Against Various Species.

The greater part of the investigational work with benzene hexachloride to date has been directed against grey-back grubs or beetles, but in some cases the trial plots carried an appreciable infestation of grubs of *Lepidiota consobrina* Gir., whilst other trials were set out in areas usually infested by *Lepidiota frenchi* Blkb. Evidence showed that row applications in excess of 200 lb. of 10 per cent. dust per acre were causing a marked reduction in *L. consobrina* infestations. Later inspections revealed that in both *frenchi* and *consobrina* infestations the 100 lb. treatments were affording some protection, since treated areas disclosed green undamaged cane, whereas cane in the untreated rows had yellowed badly. Protection in these cases may be due to some immobilizing effect on the older larvae. In the Isis area portion of a block which was carrying a fairly heavy infestation of grubs of *Pseudoholophylla furfuracea* Burm. at the final ploughing in March, 1947, was treated a few weeks later with amounts of benzene hexachloride dust varying from 50-200 lb. per acre. By October, 1947, the treated rows were showing an obvious advantage over the untreated rows adjacent. However, in the case of a heavy infestation by *Lepidiota trichosterna* Lea in ratoon cane in the Bundaberg district in March, 1947, different dosages up to 400 lb. per acre

were apparently quite ineffective in dealing with third-stage grubs that were located well inside the underground portions of the stools. The explanation appears to be that they did not come in contact with the benzene hexachloride which had been applied in furrows at the side of the cane rows.

Broadcast Application.

Broadcast applications, disced in, and ploughed in, have been set out in several centres in North Queensland, as well as in the Isis district in South Queensland. From these experiments it is hoped to ascertain if this method of application is more effective than row applications in dealing with young grubs of these two-year-cycle beetles. Similar trials have also been established against the one-year-cycle grey-back grubs. On the face of it, broadcast applications would appear to have much to commend them, provided of course that this method of application does not require a greater quantity per acre than is now being used with success as a row dressing. It is realized that the same quantity applied as a broadcast dressing will result in a reduced concentration of the insecticide, but this may still be sufficiently toxic to destroy beetles emerging from the soil or re-entering it to oviposit. In addition, blanketing the area with benzene hexachloride increases the possibility of destroying any small grubs soon after they hatch and before they are able to build up any appreciable resistance or tolerance to the insecticide. This aspect of the problem is being watched closely at the present time.

Persistence of Toxicity.

One pleasing feature associated with the use of benzene hexachloride is the length of time the material will remain toxic when applied to the soil. This attribute is of particular value in dealing with infestations resulting from two or more beetle flights or from a protracted flight such as sometimes occurs during a wet spring-summer period. It was realized early in the investigations with this compound that benzene hexachloride, applied in November, was still able to kill grubs some four months later. Since then it has been demonstrated that August applications were effective in the following March, thus involving a period of toxicity of at least seven months' duration. The possibility of this material remaining effective from the plant crop to the following ratoon crops is being examined carefully in current experiments.

Conclusion.

In the latter half of 1947 more than 120 tons of 10 per cent. benzene hexachloride dust were sold to Queensland cane growers for application to canefields that were expected to become grub infested during the early months of 1948. The bulk of this material was applied at the recommended rate of 100 lb. per acre, representing approximately 2,700 acres treated. This is almost double the acreage fumigated in any one year with carbon disulphide when the latter was at the height of its popularity and when its application was not restricted by any shortage of labour or material. In the case of benzene hexachloride, however, more would have been applied had further supplies been available in October, 1947. Its meteoric rise in popularity with cane growers is due simply to the fact that it gives promise of being one of the most efficient and useful insecticides yet developed for the control of the worst sugar-cane "white-grub" pests in Queensland. Many of the earlier experiments that were

rendered inconclusive as a result of the 1946 drought have been either slightly modified or repeated during 1947, and from them it is hoped that further data will be secured concerning the optimum rate, time, and method of applying this new insecticide. Cane Pest Boards have also co-operated by conducting further experiments along somewhat parallel lines. Even should it be found advisable to adhere to the present recommended rate of application the use of benzene hexachloride in canefield areas is certain to be extended. It has already reduced considerably the costs of control when compared with methods hitherto used in combating these grub pests.

Summary.

Benzene hexachloride was found to give adequate protection against grey-back grubs when used as a drill dressing at the rate of 100 lb. of 10 per cent. dust per acre and applied before beetle flight.

It has no apparent toxic effect on sugar cane when used at the minimum strength necessary for effective grub control.

Experiments are in progress to determine the optimum rate, time, and method of applying benzene hexachloride to various types of soil infested by grubs.

The value of broadcast dressings as a means of dealing with beetles and young grubs is also being tested.

One hundred and twenty tons of 10 per cent. benzene hexachloride dust were applied to 2,700 acres of cane land expected to be grub infested during the early part of 1948.

Benzene hexachloride has cheapened materially the cost of grub control in Queensland canefields, and its use for this purpose is sure to be increased.

REFERENCES.

[1] SLADE, DR. ROLAND: 1945. "The gamma isomer of Hexachlorocyclohexane ('Gammexane'), an insecticide with outstanding properties." Hurter Memorial Lecture, March, 1945.

[2] HOMES, DR. E.: 1945. "666: An insecticide triumph of British Chemical Industry." Industrial Pest Control Association, April, 1945.

Bureau of Sugar Experiment Stations,
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Results of a Two-cycle Fertilizer Trial.*

THE INTERACTION OF NITROGEN AND POTASH.

By L. G VALLANCE.

Introduction.

A POINT that is often overlooked in the fertilizing of sugar cane is the necessity for maintaining a correctly balanced nutrient supply. This has been repeatedly stressed by many workers and has been borne out by a great deal of experimental work. Sugar cane, in common with most other plants, will not exhibit the maximum response to any particular plant food if another essential element is lacking or is not present in sufficient quantity. This is very clearly illustrated by the results of a fertilizer trial carried out on a red volcanic soil at the Bundaberg Sugar Experiment Station. The red soils of this district are notoriously deficient in potash, and this fact is so well known that, in the effort to overcome the deficiency, many growers unwittingly overlook the necessity for ensuring an adequate supply of nitrogen.

Description of Trial.

The experiment was carried out through two crop cycles, each of which consisted of a plant, a first ratoon and a second ratoon crop. After the second ratoon crop of the first cycle was harvested the stools were ploughed out and the experiment replanted on the same site. The variety was changed at replanting; Co.290 being used in the first cycle and Q.25 in the second. The layout was of the usual factorial design ($3 \times 3 \times 3$) in which the responses to nitrogen, phosphoric acid and potash were compared at three different levels. These levels were as follows:—

1. Ammonium sulphate—nil
2. „ „ —120 lb. per acre
3. „ „ —240 „ „ „
4. Superphosphate—nil
5. „ —400 lb. per acre
6. „ —800 „ „ „
7. Muriate of potash—nil
8. „ „ „ —180 lb. per acre
9. „ „ „ —360 „ „ „

Each of the six crops was fertilized using the above quantities of fertilizer. These amounts were combined in all possible ways so that within each crop there occurred 27 plots, each of which was fertilized with a different combination of the three levels of nitrogen, phosphoric acid and potash. The superphosphate and muriate of potash were placed

* Paper presented at the Maryborough Conference, Q.S.S.C.T., April, 1948.

in the drill at planting and at ratooning according to the usual practice, while the sulphate of ammonia was applied some weeks later as a top-dressing. The history of the trial is as follows:—

—	First Cycle.	Second Cycle.
Planted	Feb., 1937	Feb., 1941
Plant crop harvested	Sept., 1938	Aug., 1942
First ratoon harvested	Oct., 1939	Oct., 1943
Second ratoon harvested	Aug., 1940	July, 1944

A leguminous crop was grown and turned in during the fallow period between August, 1940, and February, 1941.

Results.

As is usual with this red volcanic soil (which is well supplied naturally with phosphoric acid), no response was obtained from the superphosphate applications. There was a marked response to both nitrogen and potash, and this is brought out by the data shown in Table I. The figures given in this table represent the *total increases* in tons of cane per acre which occurred over the *six crops* due to the various combinations of nitrogen and potash.

TABLE 1.
TOTAL INCREASE* IN YIELD (TONS PER ACRE).

Sulphate of ammonia top dressing (bags per acre).	1 bag (approx.) potash per acre.	2 bags (approx.) potash per acre.
nil	no significant increase	no significant increase
¾	25	29
1½	28	37

*These increases are significant at the one per cent. level.

From these results it is quite evident that, although this soil is markedly deficient in potash, no increase in yield was obtained from the application of potash unless nitrogen was also applied. Where no sulphate of ammonia was given as a top-dressing, the addition of either one or two bags of potash was without result. However, when ¾ bag of sulphate of ammonia was used the application of one bag of potash increased the total yield over the six crops by 25 tons of cane per acre. It is interesting to note that the yield was only slightly increased by the addition of a further bag of potash. This latter increase was not well defined, and it may be concluded that the lighter dressing of sulphate of ammonia had not supplied sufficient nitrogen for the plant to take full advantage of the extra bag of potash. However, when 1½ bags of sulphate of ammonia were used as a top-dressing there was at once a response to the extra bag of potash and the greatest increase of 37 tons per acre was recorded. Where only one bag of potash was used in conjunction with 1½ bags of sulphate of ammonia there was practically no increase in yield over that obtained with the top-dressing consisting of ¾ bag; thus indicating that the lighter application of potash was not sufficient to allow complete utilization of the heavier top-dressing of nitrogen.

Conclusion.

These red soils have the reputation of very often showing little response to top-dressing with sulphate of ammonia. When this occurs the question immediatedly arises as to whether sufficient potash has been used. Conversely, if the naturally potash-deficient condition of these soils is to be satisfactorily overcome, then it would appear that the application of potassic fertilizers will only be effective if the crop has been adequately top-dressed with sulphate of ammonia.

Acknowledgement.

Thanks are due to Mr. P. McGovern, Biometrics Section, Department of Agriculture and Stock, for the statistical analysis of this trial, the relevant portion of which is given in Appendix I.

APPENDIX I.

Mean yields (tons cane per acre) of First plus Second Cycle Interaction of Nitrogen and Potash.

Nitrogen.	Potash.			
	K_0.	K_1.	K_2.	Mean.
N_0	137·23	148·16	149·9	145·1
N_1	134·53	159·83	163·1	152·49
N_2	142·3	169·9	179·4	163·87
Mean	138·02	159·3	164·13	153·82

Necessary differences for significance.

a. Marginal means = 8·539 at 5 per cent. level
= 11·808 at 1 " " "
b. Individual means = 14·787 at 5 " " "
= 20·449 at 1 " " "

Bureau of Sugar Experiment Stations,
Brisbane.

Variations in Primary Vigour in the Variety Q.28.

By W. A. McDOUGALL, D. R. L. STEINDL, and J. T. ELLIOTT.

DISAPPOINTING tonnage yields and crop behaviour in some Mackay fields cannot always be attributed to faults in cultivation and harvesting routine, or to weather conditions, fertilizer practices or interference by known diseases and pests. A field may be planted to the one variety from two sources, and although all material is similar in age, state of growth and sugar content, a significant difference in yield and behaviour can be correlated with the plant source. The full effect of this reduced yield is not apparent until ratooning; the plant crop may have picked up lighter than could be expected, but this in itself need not point to a ratoon failure—for instance, ratoons from grubby plant cane of the same variety under somewhat similar conditions

may be good. This lack of primary vigour in planting material has been recognized by farmers and fieldmen over many years, but the true cause is not known. Several suggestions have been offered, but with the numerous factors involved it seems beyond field observations alone to provide a satifactory explanation.

Specific examples of what appears to be lack of primary vigour have been noted in M.1900, E.K.28 and P.O.J.2878 in the past, and farmers who have combated it by periodic changes in plant sources must have experienced the phenomenon in many other canes.

During the past five years the trouble has been most pronounced in the new Bureau seedling Q.28, which has made a very rapid and extensive spread throughout the district. Whether this trouble is similar to that which has occurred to a lesser extent in other varieties is not known; however, it is more spectacular in this variety, and the difference between good and poor crops growing under identical conditions in the one field is so marked that many growers at first consider that there are two kinds of Q.28.

FIG. 14.—Showing poor Q.28 on left and good Q.28 on right. All cane is first ratoons and was planted and harvested at the same time.

The fact that there were both good and poor sources of Q.28 was first brought to the notice of Bureau officers in 1944, and since then the poor material has been unwittingly distributed by farmers over a wide area. It was estimated by the Mackay Cane Pest and Disease Control Board officers that the trouble caused a loss of approximately 25,000 tons of cane for the 1947 harvest. The chief reason for the increase in area of poor cane is that under reasonably good growing conditions the trouble is not detected in plant cane, which is the main source of planting material.

The disorder is definitely transmitted through the planting material, and no cases of permanent recovery have been observed. To what extent it is occurring spontaneously is not quite clear at present, but apparently it has developed independently on at least half-a-dozen farms. These farms are mainly on the low-lying, poorer forest soils, and there seems to be a definite danger in taking plants from these soils to the better class of well-drained soil.

Plant cane from a poor source does not always show the trouble to any marked degree, and under good growing conditions a reasonably good crop may be obtained; however, if a dry spell is experienced the poor material is the first to show symptoms of distress, such as wilting and scorching of the leaves. It has also been noticed that poor plant crops usually have less sticks per stool, even when the crop appears normal in other respects.

Very young ratoons usually come away normally and there is seldom any dying out of complete stools in the early stages of growth; however, it is not long before differences can be seen between good and poor fields, or parts of fields, and dry spells affect the poor ones sooner and more severely than the normal ones. A typical example of ratoons from good and poor Q.28 at the beginning of the wet season can be seen in Fig. 14.

FIG. 15.—Same field as Fig. 14, showing occasional good stools in the poor section and good cane in the background.

Typical symptoms of the trouble in more mature cane are a very marked shortening of the sticks and a reduction in the number of sticks per stool. Affected sticks are reduced in thickness, but not to a very marked degree, nor is the length of internode reduced as much as might be expected. Under the dry conditions which prevailed during the winter and spring of 1947 the leaves and tops of affected cane withered and dried out very considerably, and many fields appeared to be quite dead whereas healthy fields alongside were a normal green. Closer examination of these fields revealed that the growing points and sticks remained alive for a considerable period after all the leaves had died; however, by harvesting time much of the cane was a total loss. Under less severe climatic conditions the cane may not die, but growth is poor and a serious reduction in yield is experienced.

The trouble has not been observed in patches; either whole fields or sections of fields corresponding with different sources of planting material are affected, although frequently odd stools of good cane are

found scattered throughout poor fields (see Figs. 15 and 16). The application of fertilizer does not appear to have any curative effect on poor crops; several growers have applied heavy dressings of ratooning mixture and sulphate of ammonia without results.

Irrigation, however, does appear to mask the trouble to a large extent, and it is possible to grow affected cane under irrigated conditions without a noticeable reduction in yield, but when this cane is planted out on dry farms the trouble re-appears in the resulting crops. This fact, together with observations on the poor drought resistance of affected cane, suggests that the trouble may be bound up with the water-absorbing or -conducting power of the plant.

FIG. 16.—First ratoon Q.28 about nine months old, showing good cane on left and poor cane on right with one good stool near headland.

In view of the proved usefulness of Q.28 on the Mackay forest soils this variety warrants another trial where failures have been experienced. Farmers who have had disappointing results from the variety should, therefore, obtain plants from a reliable source, and in doing so the following points should be considered:—

(1) Do not use plant cane unless it is known to have a satisfactory history. If in doubt it would be better to use a well-grown crop of first ratoons for planting material.

(2) Avoid using irrigated cane for planting material unless such cane has a reputation for giving good results on dry farms.

(3) Do not take plants from the low-lying, poor forest soils to the better class of well-drained soils.

The Cane Pest and Disease Control Board officers will supply farmers with information regarding reliable sources of plants.

A number of growers who have suffered crop failures with Q.28 have obtained fresh supplies of plants from a source known to provide well-grown material with good primary vigour, and the results have been most satisfactory.

During the past year the Bureau has set out a number of plots in an attempt to throw some light on the nature of the trouble, and the results will be looked forward to with interest.

The Field Identification of Cane Grubs.*

By J. H. BUZACOTT.

Introduction.

FOR the field man whose work includes the supervision of grub-control measures, a simple means for the identification of the several species of grubs which attack sugar cane is important. Whilst it is not necessary to be able to identify all the species of white grubs which may be found associated with sugar cane, it is at least desirable that those species can be recognized which attack sugar cane and which warrant the institution of control measures. Information regarding the identification of white grubs has been published by various authors, including Girault and Dodd [2], Dodd [1], Jarvis [3, 4 and 5], and Mungomery [6]. The publications by the two former authors are highly technical and unsuitable for field use, whilst references by Jarvis are generally scattered through many publications and not available for handy reference. It is the object, therefore, of this paper to set out in simple form a means of identifying the principal species which are injurious to sugar cane. Whilst the method adopted is not infallible, it is sufficiently accurate for the use of field officers, since the few species which cannot easily be separated on structural characters are generally restricted to different areas either by soil type or climatic conditions.

Method.

A complete key for the separation of all the species of white grubs which occur in Queensland canefields requires the use of minute differences in the structure of various parts of the grub. To use such a key requires an intimate knowledge of both the physiology of insects and the terminology used in the description of parts. Fortunately, however,

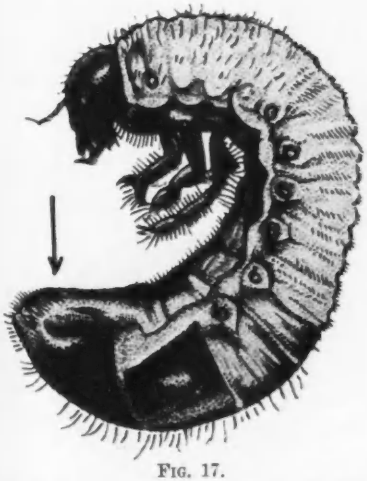

FIG. 17.

FIG. 18.

* Paper presented at the Maryborough Conference, Q.S.S.C.T., April, 1948.

most of the injurious species may be separated by differences which occur in the distribution of the bristles, or *setae* to give them their correct term, which are situated on the ventral surface of the apex of the abdomen of grubs. In the harmful species some of these *setae* are gathered into a definite group which encloses an area known as the anal path. The number of *setae* which outline the anal path and also the shape of the path are reasonably constant for any species of grub, although they vary considerably from one species to another. Certainly the size of the anal path differs according to the stage of the grubs, but in any species the number of *setae* and the shape of the path are the same in Stage I as they are in Stage III. Accordingly, this method of identification applies equally well to any stage of the grub. The anal path may be examined in the field with the aid of a hand lens with a magnification of from six to ten diameters, and the position in which to look for the path is shown by the arrow in Fig. 17.

Descriptive.

In the following descriptions an attempt has been made to simplify the references as much as possible by adopting the name in common use for the species concerned. In most instances this is the specific name of the grub; however, in order to avoid any confusion, the correct scientific name of each species is also given. The species which mainly concern us as serious pests of sugar cane are the "grey-back" grub, the "frenchi" grub, the "caudata" grub, the "consobrina" grub, the "Childers" grub, and the "trichosterna" grub. Species which occur very commonly under cane stools but seldom, if ever, cause economic damage are the "Christmas" grub, the "red-head" grub, and the "anomala" grub. Other grubs which are not so common but which are often found when digging out cane stools are the "elephant" grub, the "rothei" grub, and a number of very small species which belong to the genera *Heteronyx, Haplonycha,* and *Neso.*

The Grey-back Grub—*Dermolepida albohirtum* Waterh.

The grey-back grub has an anal path which consists of a narrow tract delimited by approximately 26 *setae* on each side (Fig. 18). Whilst the path is readily visible, the *setae* which bound it are not very dark and are well separated. The only grub with which the grey-back is likely to be confused is the anomala grub (*q.v.*).

The Frenchi Grub—*Lepidiota frenchi* Blackb.

The frenchi grub has a pear-shaped anal path with about 50 *setae* on each side (Fig. 19); the centre of the path is more or less bare. It

FIG. 19.

FIG. 20.

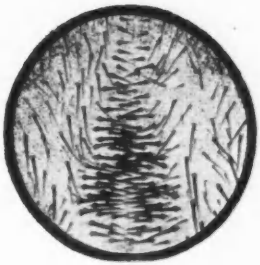

FIG. 21.

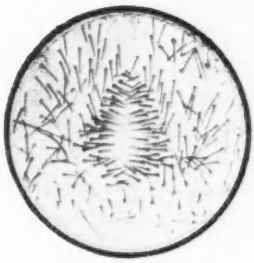

FIG. 22.

can easily be confused with that of either the caudata or consobrina grub, and, indeed, the main difference between these three species is distribution since they all cause the same type of damage to sugar cane. Frenchi has a very wide range and occurs in all cane areas from Maryborough to Mossman.

The Caudata Grub—*Lepidiota caudata* Blackb.

The caudata grub also has a pear-shaped anal path very similar to that of frenchi, except that there are about 40 *setae* on each side (Fig. 20). In addition, the *setae* are long and tend to project over the centre of the path so that there is no bare centre. Caudata is confined to "scrub" country and is mainly a pest in areas such as Babinda, South Johnstone and Tully, where many of the farms adjoin heavy rain forest. It is also a serious pest of grassland in some localities on the Atherton Tableland.

The Consobrina Grub—*Lepidiota consobrina* Gir.

The consobrina grub has an anal path almost identical with that of frenchi except that the apex of it is prolonged in two straight rows (Fig. 21); thus the path becomes almost kite-shaped. Consobrina occurs mainly in forest areas in the Gordonvale and Mossman districts where much grey, clayey soil occurs. The grub is considerably larger than frenchi when fully grown, but size is generally rather an unreliable guide.

The Childers Grub—*Pseudoholophylla furfuracea* Burm.

The Childers cane grub is a serious pest in parts of the Isis, Bundaberg and Gin Gin districts of South Queensland. It has an anal path which also somewhat resembles that of frenchi, but it has less *setae* in it and shows a greater bare centre in the path (Fig. 22).

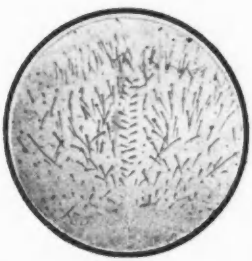

FIG. 23.

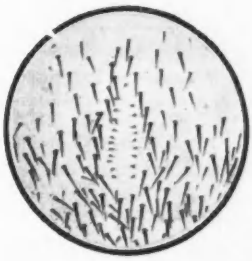

FIG. 24.

The Trichosterna Grub—*Lepidiota trichosterna* Lea.

The trichosterna grub is also restricted to South Queensland and occurs mainly near Gin Gin. Its anal path differs considerably from that of any of the other grubs, and there should be no difficulty in recognizing it from the picture (Fig. 23). The path delimited by the *setae* is very narrow and the adjacent *setae* are well separated.

The Anomala Grub—*Anomala australasiae* Blackb.

Although not a pest of sugar cane in Queensland the anomala grub is important on account of its resemblance to the grey-back grub. It has a rather obscure anal path of similar shape to the grey-back but bounded by only 11 or 12 rather short, fine *setae* on either side (Fig. 24). The full-grown grey-back grub is several times as large as a full-grown anomala grub, but there is a strong possibility of confusing a third-stage anomala grub with a second-stage grey-back or a second-stage anomala with a first-stage grey-back. Anomala grubs occur at times in considerable numbers under cane stools, and the failure to make a close examination might lead to a false picture of grey-back infestation. There is no record in Queensland of economic damage to sugar cane by anomala grubs, although a related species is a cane pest in Hawaii.

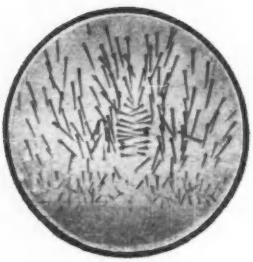

FIG. 25.

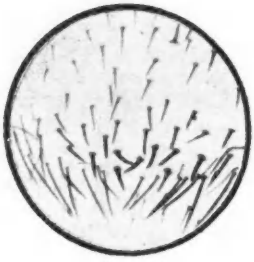

FIG. 26.

The Rothei Grub—*Lepidiota rothei* Blackb.

Of the other grubs found commonly under cane stools, practically all are small and only likely to be confused with the younger stages of the pest species. Of them the rothei grub has an anal path (Fig. 25) which somewhat resembles that of anomala. It has approximately 10 *setae* on each side, but these are relatively longer and much closer to one another than those of either anomala or the grey-back. At the present time this grub is rarely met with and is mainly a pest of grasslands; however, it is possible that with new land brought into cultivation under the soldier settlement scheme the species may become common again for a period. The other small species are "heteronyx" with a Y-shaped anal path and "haplonycha" with a horseshoe-shaped path. They are both very distinct and are not illustrated.

The Christmas Grub—*Anoplognathus boisduvali* Boisd.

The Red-head Grub—*Dasygnathus australis-dejeani* Macl.

The Christmas grub and the red-head grub belong to different groups from all the foregoing. They have no defined anal path and the posterior end of each resembles the photograph (Fig. 26), which

actually shows the anal region of the red-head grub. Christmas grubs appear to feed mainly on decaying roots and humus, and are often found in large numbers under cane stools. The writer has seen up to sixty of these grubs under a single stool without apparent harmful effect. Red-head grubs are usually found plentifully in the soil where much organic matter is present such as decaying trash, rotting stools, &c. They appear to be entirely humus feeders and rarely cause any damage to cane even when present in numbers. The chief observable difference between Christmas grubs and red-head grubs is in the colour of the heads, which in the former are dark orange and in the later are dark red. These two grubs can be distinguished from all the previously mentioned grubs due to the fact that if they are placed on a level surface they will, in a minute or two, commence to crawl away on their belly, whilst the grey-back, frenchi, caudata, consobrina and others of that group are incapable of doing this. The latter group cannot straighten the rear portion of the abdomen and can only progress in an awkward hobble with the body lying to one side.

The Elephant Grub—*Xylotrupes australicus* Thom.

Possibly one other grub calls for some comment. This is the elephant or rhinoceros grub. It is purely a humus feeder and commonly found in dumps of stable manure or masses of rotting vegetation. It is sometimes found under cane stools but is easily distinguished by its large size, very bulky body and the dense reddish hairs with which the body is clothed. The species has no defined anal path and resembles the Christmas and red-head grubs in this respect.

Acknowledgements.

Some of the photomicrographs presented in the plate were taken by Messrs. E. Jarvis, W. C. Dormer and E. V. Humphry, to whom due acknowledgement is given.

Summary.

A method for the identification of the various species of white grubs which attack sugar cane in Queensland is presented. Photomicrographs of the anal paths of the grubs are used to illustrate the differences and a short note on the anal path of each species appears in the text.

REFERENCES.

[1] DODD, A. P.: "The Cane Grubs of Australia," Pt. II.—Qld. Bur. of Sugar Expt. Stns., Div. of Entomology. Bull. No. 6—1917.

[2] GIRAULT, A. A., and DODD, A. P.: "The Cane Grubs of Australia," Qld. Bur. Sugar Expt. Stns., Div. of Entomology. Bull. No. 2—1915.

[3] JARVIS, E.: "Notes on Queensland Cane Insects and their Control." Qld. Bur. of Sug. Expt. Stns., Div. of Entomology. Bull. No. 17—1923.

[4] JARVIS, E: "Notes on Queensland Cane Insects and their Control." Qld. Bur. Sug. Expt. Stns., Div. of Entomology. Bull. No. 18—1925.

[5] JARVIS, E.: "Some Notes on the Economy of Cockchafer Beetles." Qld. Bur. of Sug. Expt. Stns., Div. of Entomology. Bull. No. 20—1929.

[6] MUNGOMERY, R. W.: "The Childers Cane Beetle." Qld. Bur. Sug. Expt. Stns., Div. of Entomology. Farm Bull. No. 4—1932.

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Gordonvale.

Sporting in Cane.

By C. G. HUGHES.

THE term "sporting," when used in the sense intended here, is simply the name applied to the inexplicable variations which occur in a field of cane; not those caused by insects or pests or bad soil or atmospheric conditions, but those which arise within a stool, when one shoot may grow white instead of green, for instance, or a striped cane appear in an otherwise normal stool.

For commercial purposes cane is propagated asexually, i.e., by taking buds from pre-existing plants, and not by the production of new plants per medium of seeds. In contrasts to the asexual propagation of cane may be mentioned the sexual propagation of wheat, lucerne, green manures and a host of other commercial plants, all of which are multiplied in numbers of individuals by the use of true seeds. As an example of asexual propagation apart from cane let us consider the apple. Everyone, even cane growers in the tropical country where it cannot be grown, knows that this fruit is propagated asexually, i.e., by buds; true seeds can be germinated, of course, but the trees resulting would not be the same as the parent. Take *any* Granny Smith apple tree, for instance; it was produced by a bud which came from a Granny Smith tree, which in turn came from another tree of the same sort, and so on right back to the original tree, the first Granny Smith in existence. The point of all this is that every single Granny Smith tree of the millions now in the world is descended from the one tree, and, if identical conditions of growth could be arranged, would grow, and behave and produce in exactly the same way as every other. All Granny Smith plants, then, have the same genetic make-up. Exactly the same thing occurs with sugar cane. Let us take, say, the variety, P.O J.2878, well-known at least by name to all Queensland cane farmers. It originated as a single seedling at the Experiment Station in Java. Buds, i.e., setts containing buds, were taken from this stool and planted; setts were cut from the grown stools from them and again planted, and so on until every sugar-producing country in the world possessed stocks of the cane, and the tonnage produced by it ran into millions of tons each year. Every single one of this enormous number of stools has the same capabilities as every other or, to put it another way, all have the same genetic make-up.

However, there is one point with regard to both the Granny Smith and the P.O.J.2878 which has not yet been mentioned. It is that, although the generalization that every plant of a particular variety in an asexually propagated crop has the same genetic make-up as every other still holds, exceptions, which are different from the general crowd, do occur. These different plants or "sports" arise suddenly without any apparent reason. Nobody has been able to explain why a growing bud, whether situated at the apex of a stick or on the side, whether above ground or below, will sometimes produce something different from that produced by its fellows and its ancestors through countless generations. The occurrence is very rare, considering the number of buds produced even in a single acre—the chances of sporting in a

particular bud in a field of an ordinary commercial variety are probably of the order of millions to one—although at times varieties particularly susceptible to sporting do occur.

In cane, the sport may show a marked change in colour compared with the normal colour of the stalks, the top, or the individual leaves. The variety Benbow, or P.Q.1, is a cane which was picked out of a field of the usual type of Clark's Seedling; the sport has a green stem instead of the normal brown. Q.813 is another variety which at different times has sported to give a green cane instead of a red, or a striped cane instead of the usual whole colour. Sometimes a bud will sport to give a perfectly white shoot or to give long, white stripes on the normal green of individual leaves. The latter, which by their regularity and clean, white colour are easy to distinguish from stripes due to diseases, are usually referred to as "chimeras" (pronounced "kymeras"). It must be emphasized that the production of sports is a function of individual buds so that only the product of a single bud is affected; this may be a single top, a side shoot, a stick, several sticks, or even a whole stool, if it came from a single bud. A whole paddock will not sport to produce, say, canes of a different colour or with stripes; there is no sporting *en masse*.

A sport is a variation from the normal and may take place in any direction, i.e., it may be an improvement or the reverse, or, on the other hand, it may have no effect on the commercial crop. It may not always be visible, as with change of colour, and it is quite possible that an increase (or decrease) in sugar content could occur, but the chances of picking up a variation even with examination of single sticks would be very remote, since differences due to such factors as soil, insects, &c., would be so great as to conceal the effect of the sporting. It is a fact that each sport occurs independently of every other one so that unless a bud sported twice, which would be a most unlikely occurrence, a change of colour in the stick, for instance, could not be associated with a change in the sugar content. There is no proof whatever, and no examples in cane are known, of a change in colour being associated with any improvement in c.c.s., cropping power, ratooning ability or any other characteristic of commercial canes. So while recognizing that sports and sporting do occur in cane we must conclude that they are of no, or, at the most, very little importance; firstly, because they are few in numbers and the beneficial or harmful ones would be even fewer, and secondly, because nearly all the obvious, conspicuous changes often caused by sporting cannot be associated with any changes in commercial attributes.

Proclamations under Sugar Experiment Stations Acts.

"*The Sugar Experiment Stations Acts,* 1900 *to* 1947," provide that proclamations may be issued from time to time in order to give special application to general provisions of the Acts. Since the amendment of these Acts in October, 1938, 18 Proclamations have been gazetted. Growers have been advised from time to time by their organizations and by the Press of the substance of these Proclamations and after some ten years most growers are aware of their responsibilities in this regard. However, it becomes necessary as disease conditions alter in particular areas to amend certain of these Proclamations either for the purpose of lifting restrictions previously imposed or to allow for the more effective working of Inspectors appointed under the Acts. During the last few months certain alterations have been made regarding four of the Proclamations previously issued and we would urge a careful reading of these alterations insofar as they refer to any particular district.

Proclamation No. 2.

The wording of this Proclamation has been altered. It is a general Proclamation covering all cane areas in the State and provides that the removal of any sugar cane from or out of any plantation or place in which an Inspector knows disease to exist, and has notified the grower accordingly, or from or out of one portion of any plantation or place to any other portion of the same plantation or place (except for the purpose of milling) shall be permitted only with the approval of an Inspector. In other words, no grower who has disease on his farm may dispose of plants or use his own plants except by the permission of an Inspector appointed under the Acts.

Proclamation No. 5.

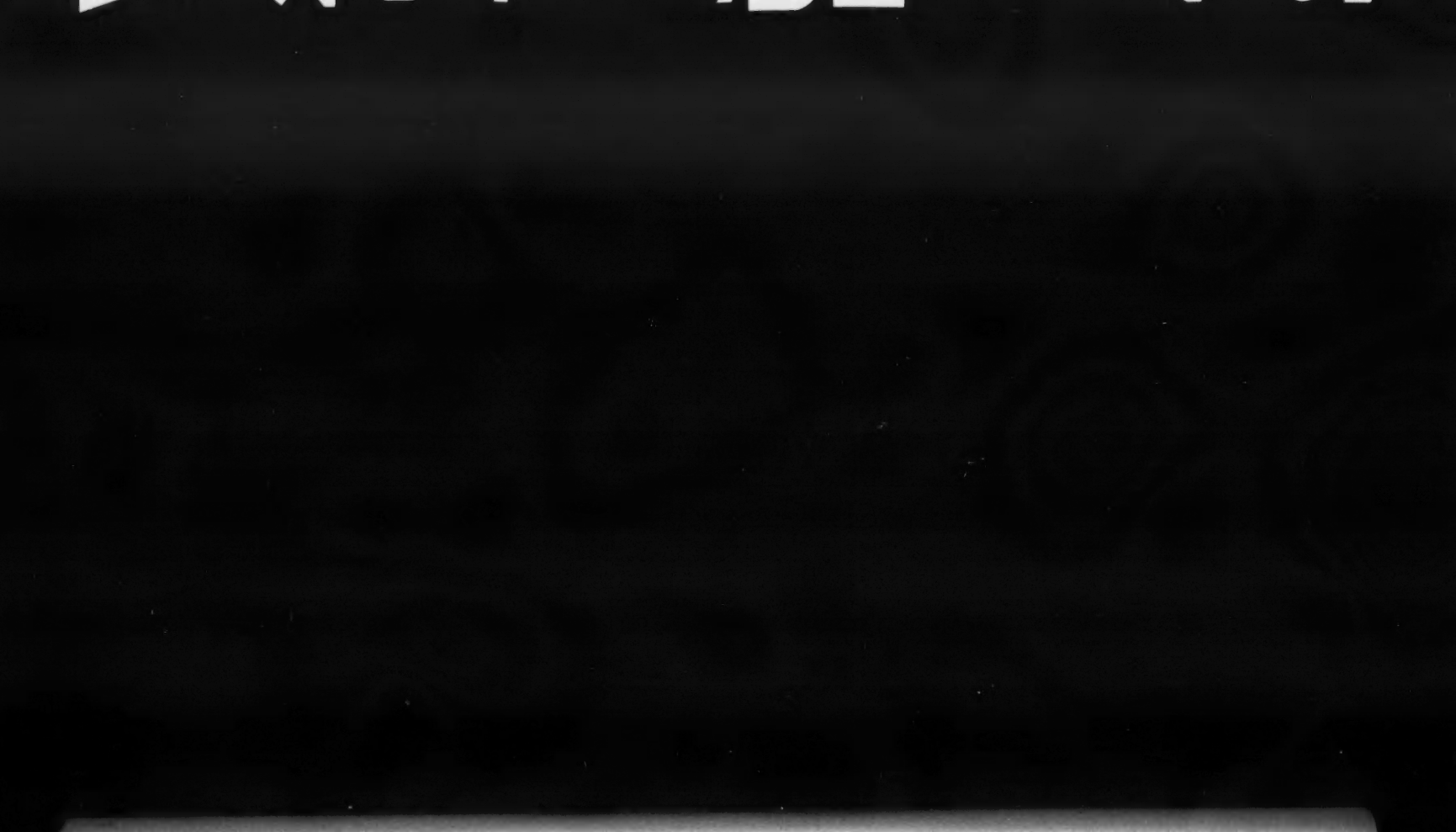
This Proclamation was designed for the Bundaberg, Gin Gin and Childers district, and prohibited the removal of cane within or out of farms may be grown for only three calendar years after the year of planting, and must then be ploughed out unless a permit to grow it during the fourth year is obtained. The varieties previously listed have been amended and those which are affected by the Proclamation are now P.O.J.2725, P.O.J.2878, and Q.25.

Proclamation No. 10.

This Proclamation dealt with the quarantine area within the Childers district, and prohibited the removal of cane within or out of that area except for the purpose of milling. This quarantine is now cancelled.

Proclamation No. 13.

This Proclamation which was made for the Moreton mill area prohibited the growing of any sugar cane of the variety P.O.J.2878 during the fourth or any subsequent calendar year after the calendar of planting on any farms which were known to be Fiji-disease infested. The Proclamation is now amended to cover the varieties C.P. 29/116 and P.O.J.2878.

—N.J.K.

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